CHAPTER 3
BASIC PERSONNEL SAFE WORKING PRACTICES

3-1. Basic safe working practices

Basic safe working practices require that the worker be in good health, not under the influence of drugs or alcohol, free of major emotional, psychological, and financial problems, familiar with the fundamentals of Safety, familiar with equipment and tool use, well prepared for each job, and always alert and responsible for his/her acts.

3-2. Fundamentals of safety

The fundamentals of safety include accident prevention and hazardous work elimination.

a. Accident prevention. ACCIDENTS DO NOT "JUST HAPPEN"—Accidents are the result of unsafe acts, unsafe conditions, or both.

(1) Unsafe acts, which cause almost 9 out of every 10 accidents, include—

(a) Operating without authority or warning, such as opening or closing switches, circuit breakers or reclosers without permission; operating hoists, trucks, or other motor-operated devices without giving a proper warning; failure to place warning signs or guards or to give signals where needed; and violation of "red tagging" rules.

(b) Making safety devices inoperative unnecessarily or without an adequate reason, such as removing guards, using oversize fuses, and blocking protective devices.

(c) Using unsafe equipment or using equipment improperly, such as using tools and chisels that are damaged, using pipe extensions on wrenches not designed for them, using the wrong tools for the job, and using your hands instead of hand tools.

(d) Unsafe loading or placing objects, such as carrying or lifting heavy loads, placing objects where they are likely to fall, unstable packing of loads, and failure to block or guard equipment against unexpected movements.

(e) Taking unsafe positions, such as working or lifting from an improper position; casual walking under suspended loads, through hazardous work areas, or close to openings; entering areas contaminated by gases or fumes without taking proper precautions; and riding in unsafe locations in or on motor vehicles.

(f) Working near live equipment, moving machinery, apparatus, or moving parts thereof, without observing prescribed safety precautions or regulations, or without using required protective devices and equipment.

(g) Distracting or startling acts, such as practical joking, horseplay, teasing, quarreling, and annoying behavior.

(h) Failure to use personal protective equipment or safe clothing, such as rubber gloves, aprons, and leggings where required.

(2) Unsafe conditions, include—

(a) Lack of shields or guards and unbarricaded floor openings or excavations.

(b) Insufficient warning signs, inadequate guards for the job, makeshift barriers, and "red tags": not properly applied.

(c) Defective material or equipment, such as broken pieces, stripped threads, split handles, and damaged tools.

(d) Hazardous arrangements, resulting from poor housekeeping or lack of planning.

(e) Unsafe personal apparel, such as neckties, jewelry, and loose sleeves, when worn near moving machinery.

(f) Improper illumination or inadequate ventilation when working in a manhole or utility room.

b. Hazardous work elimination. Hazardous work can be eliminated when workers are instilled with the habit of being cautious:

(1) Do not begin work around energized machinery or equipment or at any place where a hazard exists until adequate lighting and all proper safety measures are provided. When finished, disconnect and remove all extension power cords. Never leave extension cords which are not in use.

(2) Place DANGER signs where conditions require their use.

(3) Remove DANGER signs from places where the danger no longer exists; do not use such signs unnecessarily.

(4) Inspect all tools and equipment before using them and report promptly any defect noticed.

(5) Never work so closely to fellow workers that they may be endangered by swinging picks, shovels, or similar tools.

(6) Use nail pullers when removing nails from boxes or crates.

(7) Do not use files without proper handles.

(8) Use cribbing or other approved means to support objects raised above a working position. Do not depend upon a lifting jack for support.

(9) Do not stand or allow others to stand near ropes or cables under strain.

(10) Stop portable gasoline engines or electric motors propelling equipment such as concrete mixers, compressors, pumps, blowers, and cranes, before refueling, greasing, oiling, or repairing.

(11) When burning insulation off scrap wire:

(a) Use an incinerator, if available. If an incinerator is not available, burning should be done in the open away from buildings and flammable material. Obey local civil laws regarding open fires.

(b) Use iron forks to handle wire.

(c) Let the fire burn out before removing the wire.

(12) Report promptly and establish guards over any hazardous condition which might cause injury, property damage, or interference with electric services. This includes all hazards, such as fallen wires, open holes or ditches, and broken poles or crossarms.

(13) Keep away from dangerous places unless the work requires you to be there.

(14) Treat all electric wires and apparatus as dangerous and do not touch such equipment unless you are qualified and authorized to handle such work.

(15) Do not install fuses which are of an improper type or capacity.

(16) Do not operate portable electric hand drills, hand grinders, hand buffing wheels, or other similar equipment unless the motor casing is effectively grounded or the tool is properly labeled as “double insulated.”

(17) Casings of electric motors mounted on work benches or mounted on metal bases fastened to concrete, wood, or metal floors must be effectively grounded before operation.

(18) Do not remove broken light bulbs while working inside tanks, heaters, boilers, and other such enclosed spaces unless the cord is disconnected from the supply outlet. Empty sockets are not permitted in such places.

(19) After a natural disaster such as flood, fire, tornado, hurricane or earthquake all electrical components and devices such as switchgear, circuit breakers, fuses, transformers, reclosers, generators, electric machines, electric equipment and electric circuits must be checked and tested by professionals before re-energizing.

(20) Before starting an electrical job the working areas must be checked for safety. Accessible routes for emergency entrance and exit should be available. All obstacles must be removed and all unsafe situations must be fixed before job can be started. Unsafe personal apparel such as neckties, jewelry, watches, and loose clothes should not be worn. Personal protective devices such as safety gloves, rubber blankets, hot sticks, goggles should be available and ready for use. The workplace must be protected from unauthorized access and unforeseen accidents by one of the following means:

(a) Warning equipment. Adequate barriers, warning signs, traffic cones, and lights must be located on approaches to and at the work areas, excavations, open manholes, parked equipment; and other hazards. Special precautions must be taken for any areas where reduced visibility occurs such as night operations or in fog. Warning devices must be removed when the work is completed.

(b) Flagmen. Flagmen are necessary when warning devices are not adequate such as in traffic control. Flagmen must wear safety warning vests, operate two-way radios and carry warning signs for their protection and work area protection.

3-3. Normal environmental impacts

The environment may cause impacts on the work to be performed and potential health hazards for workers when careless or lack of site preparation exists.

a. Working in elevated positions. A safety rope should be used to attach to the worker's body when he/she is in an elevated position. To prevent the possibility of dropping materials or tools from the elevated position onto people underneath, appropri-

ate signs and guards must be used to keep people away. The supporting platforms for workers, tools, and materials must be strong and balanced for the loads they carry to prevent the risk of breaking or falling.

b. Working in confined spaces. A confined space is an enclosed space with restricted access and insufficient ventilation such as vaults, manholes, or tanks. Insufficient ventilation can result in dangerous air contamination and an oxygen deficient atmosphere. Dangerous air contamination results when there is a flammable gas or vapor exceeding 10 percent of its lower explosive limit. An oxygen deficient atmosphere contains less than 19.5 percent oxygen by volume.

(1) *Before entering into a confined space.* Prior to entering a confined space, the atmosphere will be tested by qualified personnel to determine its safety using approved combustion gas/oxygen detectors and recording the results. Where tests indicate an unsafe atmosphere, forced ventilation will be provided and no work will be started until safety has been assured by additional tests. An adequate continuous supply of air will be provided while work is being done.

(2) *Emergency case.* Entry may be made into a confined space with an unsafe atmosphere if required in an emergency but only if the worker is using a supplied air respirator or gas mask if there is adequate oxygen. Always use a safety lifeline and have a second worker standing by when an emergency entry is made.

(3) *Safety protection.* When working in a confined space that contains exposed energized parts, a worker must use protective shields, protective barriers, and insulating materials as necessary to avoid inadvertent contact with these parts. Doors, hinged panels, and the like should be secured to prevent contact with exposed energized parts.

c. Working in noisy areas. Protection against the effects of noise exposure should be provided for facility workers whenever the noise level exceeds the permissible limits shown in table 3-1.

(1) *Noise level equivalents.* As a rule of thumb, for a normal conversation that can be heard at about 2 feet (0.6 meters) distance, the noise level is probably less than 90 decibels, the point at which prolonged exposure can cause a gradual decay in hearing ability. Noise which is similar to the sound of firing from a rifle or shotgun is considered as an impulse type when maximum variation in sound level exceeds 1 second.

(2) *Occupational Safety and Health Administration (OSHA) requirements.* Table 3-1 provides the permissible noise exposure expressed in decibels (for sound levels) versus hours (for time duration). Exceeding these limits, OSHA requires that engineering noise controls, administrative controls, or personal hearing protective equipment be used. Only those hearing protectors that have been tested according to American National Standards Institute (ANSI) S3.19 will be acceptable. Ear insert devices will be fitted individually by a competent person. Plain cotton is not acceptable as a protective device. When the sound pressure level in a working area exceeds 115 decibels steady state, personal ear protection equivalent to the combination of earplugs and ear muffs shall be required.

(3) *Noise level measurements.* Noise level measurements should be made by qualified personnel using calibrated instruments.

(4) *Caution signs.* Hazardous noise level areas (greater than 85 decibels continuous or 140 decibels impulse) should be marked with caution signs indicating both the presence of hazardous noise levels and the need for hearing protection.

Table 3–1. OSHA Permissible Noises Exposures

Duration per Day (Hours)	Sound Level (Decibels)
8	90
6	92
4	95
3	97
2	100
1+1/2	102
1	105
1/2	110
1/4 or Less	115

Note: When the daily noise exposure is composed of two or more periods of noise exposures of different levels, their combined effect should be considered, rather than the individual effect of each. If the sum of the following fractions: $C_1/T_1 + C_2/T_2 + ... + C_n/T_n$ exceeds unity; then, the mixed exposure should be considered to exceed the limit value. C_n indicates that total time of exposure at a specified noise level, and T_n indicates the total time of exposure permitted at that level.

d. *Working in insufficiently illuminated areas.* Safety rules require adequate illumination for the work area. Where natural or installed artificial illumination is not sufficient temporary lighting must be provided. Ensure that temporary lighting is not

powered from the same circuit as temporary receptacles. The use of matches or open flames to provide such illumination is forbidden. OSHA requires a minimum of a 5 footcandle (or 54 lux) level in construction areas and a 10 footcandle (or 108 lux) level in electrical equipment rooms.

(1) *Spaces containing exposed energized parts.* Do not enter spaces containing exposed energized parts unless illumination is provided. Do not perform tasks near exposed energized parts where lack of illumination or an obstruction precludes observation of the work to be performed. Do not reach blindly into areas which may contain energized parts.

(2) *Temporary lighting.* All lamps for general illumination will be protected from accidental contact or breakage using approved guards. Guards are not required for flashlights. Flashlights will not have metal cases. All light metal case sockets will be grounded. Temporary lights will not be suspended by their electric cords unless cords and lights are designed for this means of suspension. Portable electric lighting used in wet or other conductive locations will be operated at 12 volts or less. However, 120-volt lights may be used if protected by a ground fault circuit interrupter. Only explosion-proof lighting equipment will be used in confined or enclosed spaces unless atmospheric tests have proven the space to be nonexplosive.

3-4. Hazardous environmental impacts

Serious bodily harm can result from contact with hazardous materials such as asbestos, polychlorinated biphenyls (PCB), and sulfur hexifluoride (SF_6). These hazardous materials can be found in old building insulation material, utility substation, old transformers, capacitors, circuit breakers, switches, and voltage regulators. They should be treated and handled Environmental Protection Agency (EPA) regulations. Wood preservative treatment products would also require special handling because of their toxicity. The following paragraphs will describe the dangers of these hazardous materials, where they are used, and how to handle them. Protective apparel and accessories are covered in paragraph 4-3. The effects of electromagnetic fields (EMF) created by high voltage electric lines will also be discussed. Requirements for protection against nuclear radiation are beyond the scope of this manual.

a. Working in asbestos areas. Asbestos had been used in years past as insulation and fire protection material. However, cutting asbestos materials will release asbestos fibers to the atmosphere. These fibers will become harmful if they are breathed into the lungs. The cells within the lungs will try to remove these fibers but will not succeed. Scar tissues will form in the lungs. Studies have shown that significant quantity of asbestos fibers in the lung can cause lung cancer. For these reasons asbestos containing products are banned from the market. However, electrical workers still have a chance to be exposed to such fibers if the existing asbestos containing products such as ceiling tiles or cement-asbestos conduits in some old buildings are accidentally cut. Therefore, before starting a job in an area where asbestos is identified, a written plan detailing compliance with Occupational Safety and Health Administration (OHSA) and the Environmental Protection Agency (EPA) asbestos abatement requirement should be developed and submitted to the Government's designated authority. No asbestos work shall be permitted without approval from the Government's authority. The disposal of asbestos containing products shall be handled by qualified personnel or contractors according to all Federal, State and local regulations.

b. Working with polychlorinated biphenyl lPCB) containing products. Because of their insulating and nonflammable properties, PCB has been used in years past as heat exchange and dielectric fluid in power transformers, capacitors, voltage regulators, and circuit breakers. Trade names for PCBs include Aroclor, Askarel, Eucarel, Pyranol, Chlorextol, Nepolin, among others. PCBs can enter the air by vaporization from a leaking container. When in air PCBs will travel by wind. PCBs will then enter the soil and water. Studies have shown that PCBs can cause serious skin diseases, liver failure, birth defects, and retardation. In 1977 the U.S. Environmental Protection Agency (EPA) banned the production of PCBs. The National Institute for Occupational Safety and Health (NIOSH) recommends that the workers not be in any workplace where the air contains more than 0.001 milligrams of PCB per cubic meter for a 8-hour workday, 40-hour workweek. Workers should be aware of all locations having PCB containing products and who to contact if there is a spill. The transportation, storage, and disposal of PCB containing products should be according to the current EPA regulations.

(1) *Handling.* PCB is a “strong solvent” and a prolonged contact will result in removing the natural skin oils. All PCB fluid shall be placed in closed containers and handled by qualified personnel.

(2) *Personal protection.* Nonabsorbent gloves (neoprene, teflon, viton, etc.), footwear, masks, and appropriate protective clothing should be worn when handling PCBs. All exposed parts of the body should be greased with either petroleum jelly (vaseline), ol-

ive oil, cold cream, or another approved skin compound. At locations where there is not sufficient ventilation, workers must, in addition, use organic vapor respirators and goggles.

(3) *Emergency case.* In case of emergency when a worker comes accidentally in contact with PCB liquid he/she should immediately wash it off with soap and water.

c. Working with sulfur hexifluoride (SF6) containers. In its pure state, SF_6 is a colorless, odorless, tasteless, nonflammable, nontoxic, and noncorrosive gas shipped in liquid form. Since it is five times heavier than air, it can act as an asphyxiant, and in a liquid state, it can cause tissue freezing similar to frost bite. Its decomposition products, which result from an electric arc or short-circuit, can be toxic. These decomposition products will recombine to form SF_6 gas or be removed by an absorber provided for that purpose within such equipment as circuit breakers and switches. SF_6 gas can leak and should always be treated as hazardous.

(1) *Handling.* Only qualified workers trained to deal with SF_6's hazardous effects can analyze, fill, and reclaim this material. Only when spills and leaks occur, should facility personnel be involved to protect the public and the workplace.

(2) *Dispersing.* No employee will work alone when dispersing SF_6. Wear approved insulating gloves, safety glasses, and appropriate protective clothing to prevent any skin contact. Remove all sources contributing to electrical arcing and heat. Provide adequate ventilation to prevent the atmosphere from becoming oxygen deficient (19.5 percent by volume of oxygen minimum). Wear a hood with an air supply line when entering an oxygen-deficient atmosphere or where an oxygen detector is not available to test air. Chemical cartridge respirators will not be used. Provide a safety line and a standby worker having another hood with an air-line as backup for the worker in the hazardous SF_6 atmosphere.

(3) *In case of fire.* Though a non-inflammable gas, SF_6 can decompose at high temperatures to yield toxic and corrosive byproducts. If a fire occurs, use an appropriate fire extinguishing agent. All fire fighters should wear correct breathing apparatus.

d. Working with wood preservative treatment products. Creosote and water-borne or oil-borne preservatives used for wood treatment can only be handled by certified pesticide applicators. Copper naphthenate preservative treatment does not require certification for its use.

e. Work around electric and magnetic fields. This section covers safety measures when working around electric and magnetic fields produced by high-voltage electric lines. A 60-hertz electric line emits an extremely low frequency (ELF) electromagnetic field (EMF) which has nonionizing rays. So far, no conclusive evidence has been proved that the EMF from ELF sources are harmful. OSHA and EPA have not concurred that “prudent avoidance” which consists of taking steps to keep humans out of such fields, is necessary.

(1) *Electric field.* Whenever there is a voltage difference between two conductive objects such as two conductors, an electric field will be developed in the space between these two conductive objects. The magnitude or strength of the electric field is proportional to the difference of voltages between the two conductive objects and inversely proportional to the distance from the object. Electric fields are measured in volts per meter (v/m). The higher the difference of voltages between two conductive objects and the shorter the distance from the object the stronger will be the electric field.

(2) *Magnetic field.* Whenever there is a current flowing through a conductor or a coil of wire wound around a piece of iron (or a permanent magnet called the “electromagnet”) , a magnetic field will be developed in the space around the conductor and between the two ends of the coil. The magnitude or strength of the magnetic field is proportional to the magnitude of the current flowing through the conductor (or the coil) and inversely proportional to the square of the distance from the conductor or the coil. Magnetic fields are measured in Gauss (G), or Tesla (T) (where one Tesla is equal to 10,000 Gausses). The larger the current flowing through the conductor or the coil and the shorter the distance from the conductor or the coil, the stronger will be the magnetic field.

(3) *Effects on human body.* Electric fields will be greatly reduced in strength by obstacles such as buildings, trees, vehicles and so on. Magnetic fields on the other hand cannot be blocked by obstacles but can be greatly reduced by the distance. Some recent studies have shown that the risks of cancer and leukemia are higher for people living near high voltage transmission lines. These health problems are suspected to be caused by the magnetic fields generated by the electric lines. However, no scientists are certain of the cause of the disease because the energy radiated by the magnetic field is very small as compared to the energy radiated by X-rays. The magnetic field energy does not have enough strength to break the bonds in the cells of human body to cause cancer or death.

(4) *Personnel protection.* The most commonly used method to protect electrical workers against electric field effects is conductive shielding. Forms of shielding include conductive clothing, gloves, insulation, and bucket liners. Another method of protection is to avoid unnecessary proximity to electric sources and reduce time of exposure to the electric fields. There is no method for magnetic field protection, except distance from the field source.

(5) *Electric and magnetic field exposure guidelines.* There are no official federal limits or guidelines on electric and magnetic fields produced by electric power lines. However, there are six states in the United States which have set some guidelines on electric and magnetic fields for electrical workers (See table 3–2).

3-5. Electric shock hazards

Electrical energy cannot be sensed by human body until contact is made. Therefore, electrical workers must always be aware of electric shock hazards. Electric shock hazards can be caused by: accidentally touching an energized line or a metal object which has different potential from ground; connecting two circuits which have phase differences, or working on an apparatus

Table 3–2. U.S. Guidelines on Electric and Magnetic Field Exposures

States	Electric Fields		Magnetic Fields		Notes
	On ROW	Edge ROW	On ROW	Edge ROW	
Florida	8kV/m	2kV/m		150mG(*)	69-230kV lines
	10kV/m			200mG(*)	231-500kV lines
				259mG(*)	500kV 2-lines
Minnesota	8kV/m				
Montana	7kV/m	1kV/m			
New Jersey		3kV/m			
New York	11.8kV/m	1.6kV/m		200mG(*)	
	11kV/m				Highway crossing
	7kV/m				road crossing
Oregon	9kV/m				

Note: ROW is the right-of-way for which a utility company acquires permanent rights that allow the utility to build, operate, and maintain its transmission lines, and the right-of-way clear of trees, obstacles, and structures for the reliability of lines and the safety of electrical workers and the public. (*) Under maximum load carrying conditions.

The International radiation Protection Association (IRPA) has also set some guidelines on electric and magnetic fields exposures for electrical workers (See table 3–3).

Table 3–3. IRPA Guidelines on Electric and Magnetic Field Exposures

Exposures	Electric Fields		Magnetic Fields	
	50Hz	60Hz	50Hz	60Hz
Occupational:				
-Whole working day	10kV/m	10kV/m	5G	5G
-short-term (*)	30kV/m	30kV/m	50G	50G
General Public				
-Whole working day	5kV/m	5kV/m	1G	1G
-Short-term (*)	10kV/m	10kV/m	10G	10G

Note: (*) For short term, electric field strength (kV /m) x hours of exposure should not exceed 80. Whole body exposure to magnetic fields up to 2 hours per day should not exceed 50G.

The American conference of government Industrial Hygienists (ACGIH) has also set some guidelines for pacemaker workers. (See table 3–4).

Table 3–4. ACGIH Guidelines on Electric and Magnetic Field Exposures for Pacemakers

Exposures	Electric Fields		Magnetic Fields	
	50Hz	60Hz	50Hz	60Hz
Occupational:	15kV/m	15V/m	10G	10G
Cardiac Pacemaker	15kV/m	15kV/m	1G	1G

Note: Protective devices such as shielded clothing, gloves, insulation bucket liners and so on, should be used where the electric field is 15kV / m or larger.

In the United Kingdom, the National Radiation Protection Board has also established some guidelines on electric and magnetic fields for electrical workers (See table 3–5).

Table 3–5. United Kingdom Guidelines on Electric and Magnetic Field Exposures

Exposures	Electric Fields		Magnetic Fields	
	50Hz	60Hz	50Hz	60Hz
Occupational:	15kV/m	15V/m	10G	10G
Cardiac Pacemaker	15kV/m	15kV/m	1G	1G

However, these guidelines are not officially approved by U.S. Government yet. It is recommended that appropriate protection measures by applied when the worker experiences discomfort in the fields.

which can have feedback currents. Prejob planning should be determined before starting work. Prejob planning includes reviewing the electrical system diagrams, inspecting the system and understanding the system's operation. All apparel, tools, and equipment needed for the job should be determined and ready for use.

a. Working near energized circuits. Electrical maintenance performed near energized circuits should be done with proper rubber blankets or other suitable guards provided as a safety measure. Safe working distance from the live apparatus or conductors should also be applied (See paragraph 3-9).

b. Potential differences. The potential differences between an energized conductor and ground, or between two energized conductors, are equally hazardous. The metal frames or enclosures of electrical components may not be at the same potential with the ground. Therefore, they should be considered as hazardous. The potential difference between conductors (including phase conductors, grounded conductors, and grounding conductors) to ground should be checked and measured. The potential difference between metal frames of electrical components to ground should also be checked and measured before starting a job.

c. Phase differences. Before connecting two or more circuits together the phases of the circuits should be checked. A short circuit will occur when two circuits having different phases are connected to each other. Only circuits of same phase can be connected. When two circuits are in-phase the voltages across the circuits will be zero. For a power system less than 600 volts a voltmeter can be used for phase testing. For a power system larger than 600 volts a hot stick and high voltage voltmeter should be used (See figs 3–1 and 3–2).

d. Feedback currents. There is always a possibility of a feedback current when working on apparatus. A feedback current can result from improper disconnection or accidental connection to a stored energy power source or electric power source. A thorough understanding of the circuitry is necessary along with proper disconnection and grounding provisions.

3-6. Electrical work

Work should be performed on de-energized electrical circuits except when continuous power is required for critical services. In all instances, electrical workers should be qualified for the work. Safety procedures should be applied and personal protective equipment should be used. Where work on an ener-

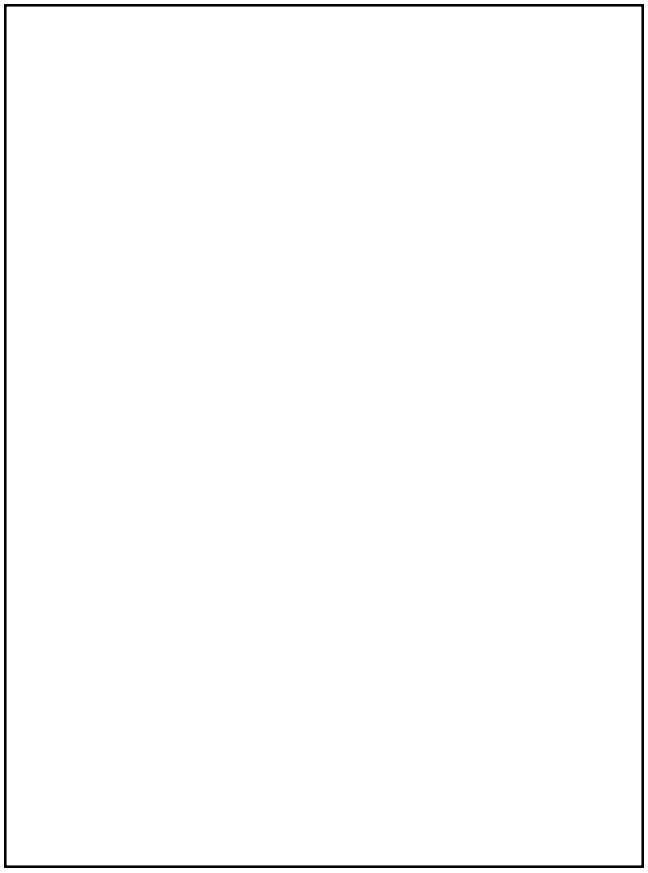

Figure 3–1. Phasing check using hot-line stick and phasing testers

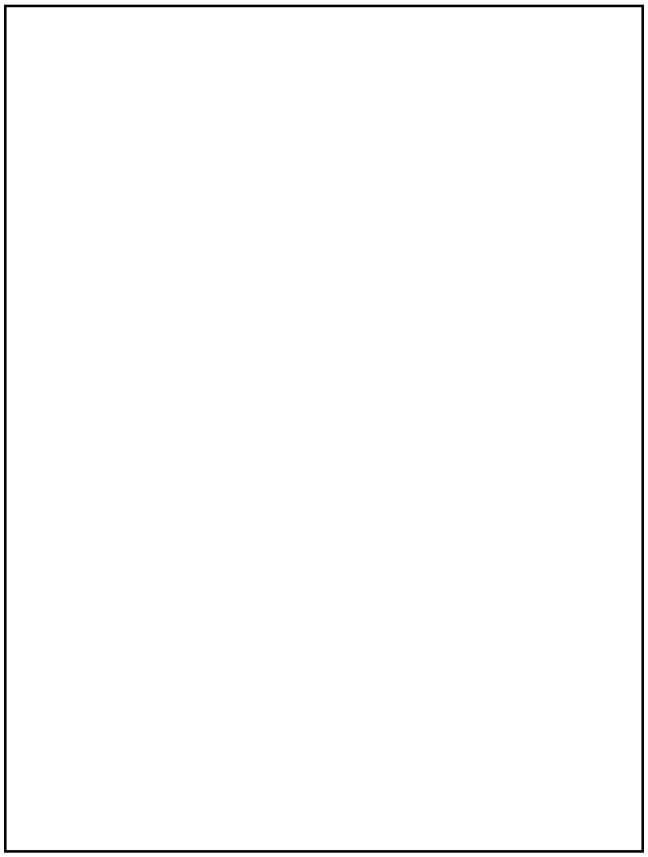

Figure 3–2. Phasing check using existing voltage transformers.

gized electrical circuit is required the worker must receive approval from his/her supervisor and the work must be performed under direct supervision of a qualified foreman.

3–7. De-energized line work

All lines are considered energized until they are completely disconnected and isolated from all electrical power sources. All stored energy sources such as power factor capacitors shall be discharged to ground through a proper grounding system before starting the job. Safety clearance should be applied. Barriers and warning signs should be used when it is necessary to prevent access of unauthorized persons to the work areas.

3–8. Safety clearance for de-energized line work

This safety clearance provides standard performances that must be applied by all electrical workers when working on de-energized lines and equipment operating above and below 600 volts.

a. Definitions of commonly used electrical terms. The most commonly used electrical terms are—

(1) *Switching.* The action of shifting, turning, or changing the existing position or direction of an electrical interrupting device such as a switch' circuit breaker or recloser to an opposite position or direction in order to connect, disconnect, or re-connect a circuit or electrical device to an electrical power system.

(2) *Blocking.* Placing a barrier to obstruct the operation of an electrical interrupting device such as a switch, circuit breaker, or recloser to prevent accidental operation.

(3) *Lockout.* The application of a locking device to the operating handle of an electrical interrupting device such as a switch, circuit breaker, or recloser to prevent the reposition of the device except when the reposition is specifically intended.

(4) *Tagging.* The action of attaching a danger tag or caution tag to an electrical interrupting device such as a switch, circuit breaker, or recloser or to an electrical rotating device such as a motor, generator, or fan or to an electrical tool such as an electric drill or screw driver.

(5) *Personnel protection ground.* A grounding system (including grounding conductors, grounding electrodes, and other grounding hardware) installed and connected into an electrical power system for the purpose of discharging electrical energy to ground to protect personnel from accidental exposure to voltage.

(6) *Clearance (danger) and caution details.* The explanation in detail of the actions or tasks associated with the application of the danger or caution tags.

(7) *Main Hold Tag.* The front side of a DA Form 7408 (Danger Tag) is designated as a "Main Hold Tag" when it is attached to a main electrical system or equipment to hold its position until the tag is removed by authorized personnel. The Main Hold Tag should not be used for any purpose other than the protection of personnel under a safety clearance.

(8) *Auxiliary Hold Tag.* The back side of a DA Form 7408 (Danger Tag) is used as an "Auxiliary Hold Tag" when it is used to disable a subsystem or equipment disconnecting devices which may affect the system or equipment covered by the Main Hold Tag.

(9) *Caution Tag.* A DA Form 5140 Caution Tag) used as a stand-alone or in conjunction with a Danger Tag. The Caution Tag is attached to a system or equipment to direct attention of electrical workers to its abnormal conditions or unusual operating characteristics.

(10) *Task.* A statement consisting of a single action verb which indicates a specific accomplishment such as "Block Switch A Open", "Lockout Switch A", or "Tag Switch A".

b. Safety clearance duties and responsibilities. The duties and responsibilities of supervisor and workers engaged in the application of a safety clearance are as follows.

(1) Supervisor duties and responsibilities. The supervisor is responsible for—

(a) Designating individual(s) authorized to receive, request, approve, issue, apply, maintain, temporary release, and terminate a safety clearance.

(b) Supervising and being responsible for the application of safety clearances.

(c) Making all necessary arrangements for interruption of electrical power service such as notifying customers and the utility company.

(d) Providing direction for the management, preparation, application, and maintenance of safety

clearance records.

(e) Conducting safety clearance training and briefing to ensure a qualified and informed work force.

(2) *Worker duties and responsibilities.* The duties and responsibilities of workers will vary depending upon duty position assignments as determined by the supervisor.

(a) Workers authorized to approve and issue safety clearances must—

1. Be technically qualified in all aspects of the electrical system and equipment operation and specifically the paths for current flow and the required positioning of the system control devices such as disconnect switches, circuit breakers, and reclosers to de-energize the system, or place other equipment into operation when it is necessary;
2. Receive requests for safety clearances;
3. Verify that the requestor is authorized to initiate a request and receive a safety clearance;
4. Review the accuracy of information entered on the Safety Clearance an or Caution Order form relative to the system or equipment involved;
5. Review the adequacy, sequence, and effectiveness of individual tasks listed on the Safety Clearance and or Caution Order form;
6. Provide guidance or correction when it is necessary;
7. Make all necessary arrangements for power interruption required for the job;
8. Notify customers and utility company when it is necessary (these arrangements must be made prior to performing any switching which may affect the customer's services and utility company's system);
9. Ensure a complete understanding of the requirements for the clearance order on the “Detail of the Clearance Procedures" including the verbal restating of the details of each individual task listed on the Safety Clearance Order to the requestor;
10. Determine and assign a Safety Clearance Order number;
11. Annotate (on the Safety Clearance Order form) the numbers of all other clearance orders which are on the related systems or equipment;
12. Fill out the DA Form 7408 (Danger Tag)
13. Issue the DA Form 5168-R (Safety Clearance Order (Electrical Facilities)) and Danger or Caution Tag to requester;
14. Issue DA Form 7407-R (Caution Order (Electrical Facilities)) and DA Form 5140 (Caution Tag) in conjunction with the Safety Clearance Order when requested;
15. Receive, review, and approve requests for temporary lift, release of temporary lift, and termination of clearance including the review of the system's or equipment's status to determine if other workers will be affected and determine the appropriate action to be taken in such a case;
16. Maintain safety clearance records including documenting clearance orders and other information relative to issuing and releasing of clearances and filing of closed-out clearance orders.

(b) Workers authorized to receive safety clearances must—

1. Meet the technical knowledge requirements specified for the individual authorized to approve and issue a clearance;
2. Be technically qualified to perform all methods necessary to accomplish the tasks required by the "Details of Clearance Procedures" on the Safety Clearance Order form;
3. Determine paths of current flow and potential feed back circuit(s) relative to the system or equipment involved;
4. Determine tasks or actions required to achieve a clearance including a sequence of tasks that will be performed to precede a clearance;
5. Prepare and submit the Safety Clearance and or Caution Order form;
6. Apply safety clearance procedures ensuring that all tasks are performed in the order and sequence as approved and listed on the Safety Clearance and or Caution Order form, annotating the time when each task is completed;
7. Conduct a safety briefing for subordinates and coworkers to ensure that they understand clearly the applied clearance requirements including familiarizing subordinates and coworkers with the positioning of all danger tags (main and auxiliary), caution tags, and personnel safety grounds;
8. Determine the requirements for temporary lift of clearances and request temporary lift of clearances including coordination and briefing other persons or crews that may have been working on the equipment or system;
9. Request authorization to release temporary lift and reapply the original clearance order including coordination and briefing other persons or crews that may have been working on the equipment or system;
10. Request authorization to release and perform the release of safety clearances including performing the tasks of unlocking, blocking, tagging, repositioning of switches, and removal of personnel safety grounds as specified in the details of safety clearance procedures;
11. Prepare turn-in and close-out danger tags to the issuing authority.

(c) Workers who receive approved (Clearance Orders must—

1. Apply the safety clearance order by implementing the tasks specified in the "Details of Clearance Procedures";
2. Perform the tasks in the order and sequence as listed;
3. Fill out the "Time Applied" for each task upon completion;
4. Ensure that the related power system or equipment is isolated from all power sources and stored energy sources and that the methods of blocking and locking are properly applied;
5. Apply Danger Tags issued in conjunction with the Safety Clearance Order;
6. Sign the "Placed By" column on both Main and Auxiliary Tags.

Note: Danger Tags must be applied at the time where the switching task is performed for the specific disconnect device identified in "Details of Clearance Procedures." All previous tags attached to the device must be removed (by a temporary lift order), except where other inherent problems preclude the removal of the tag.

7. Conduct a safety briefing, as necessary, to inform subordinates and coworkers on safety issues and concerns related to the applied clearance.

(d) Workers authorized to request Temporary Lift/ Close-Out of Clearances. Worker who receives an approved safety clearance order can request from the issuing authority a temporary lift or close-out of clearance. When this individual is not available, the supervisor can perform the request or designate a person to perform this function. The request must be approved prior to performing any task of unlocking, blocking, tagging, repositioning of switches or removal of personnel protective grounds. When a caution order is in effect as a requirement of the clearance order the following additional procedures must be performed:

1. Request temporary lift or close-out of the caution simultaneously with the request to temporary lift or close-out of the clearance;
2. Request and apply a new caution order for the system or equipment involved. The "Details of Caution Procedures" for the new caution order should be specified in accordance with the original Caution Order.

(e) Workers authorized to approve Temporary Lift/Close-Out of Clearances. Workers issuing safety clearance orders have authorization to receive and approve requests for temporary lift or close-out of clearances. However, they must review the system or equipment status to determine if other workers will be effected by release of the clearance and-determine the appropriate action to be taken in such a case. The worker must make all necessary arrangements for restoration of service such as notifying the customers and utility company. These arrangements must be made prior to performing any switching which may affect the customers' service or utility company's system. They must approve and record the temporary lift/close-out of clearance.

WARNING:

Clearance should not be released when removal of the clearance will leave other workers unprotected. In such cases, a new clearance order must be issued, as necessary, to protect the other workers. The new clearance order must be applied before the old clearance can be released.

(f) Workers who receive approval of Temporary Lift/ Closed-Out Orders must—

1. Perform the tasks of unlocking, blocking, tagging, repositioning of switches, and removal of personnel protective grounds;
2. Perform these tasks in the reverse sequence as listed on the Clearance Order form;
3. Enter the "Time Removed Column" as each task is completed.

Note: The task action to be performed during the release of a clearance is the opposite action as stated for applying the clearance. For instance, if a task of the clearance procedure reads "Open Switch A" the opposite operation is "Close Switch A".

4. Remove all clearance tags;
5. Submit the closed-out clearance order with all associated clearance tags to the issuing authority.

(g) Workers who receive Turned-In Clearance Orders and Tags must complete the termination of clearance by entering the "Released By" and "Accepted By" blocks and the time and date the closed-out clearance order and tags from the "active" file to the "inactive" file.

c. Safety clearance forms. There are four safety clearance forms: Safety Clearance Order, DA Form 5168R (fig. 3–3), Caution Order, DA Form 7408 (fig. 3–5), and Caution Tag, DA Form 5140 (fig. 3–6).

The preparation and application of the forms will depend on each job.

(1) *DA Form 5168-R (Safety Clearance Order (Electrical Facilities).* The Safety Clearance Order form is used for requesting and issuing a clearance for electrical work. It contains all data necessary for applying and releasing a clearance or a temporary lift of clearance. The Safety Clearance Order form

Figure 3–3. Sample of a completed DA Form 5168-R, Safety Clearance Order (Electrical Facilities).

Figure 3–4. Sample of a completed DA Form 7407-R, Caution Order (Electrical Facilities).

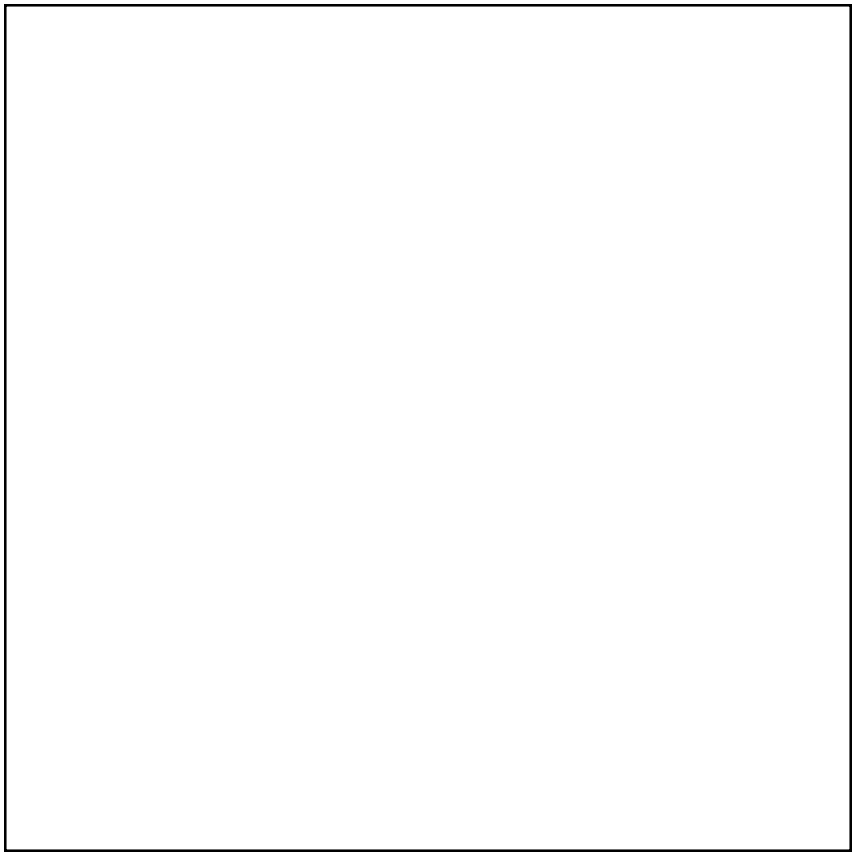

Figure 3–5. Sample of a completed DA Form 7408, Danger Tag.

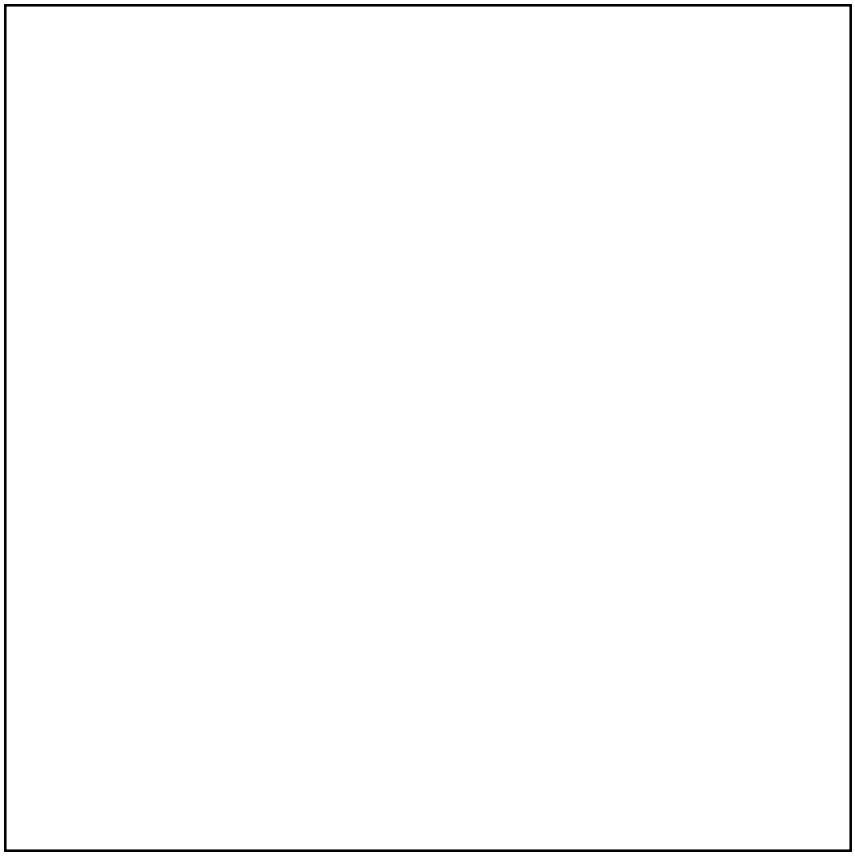

Figure 3–6. Sample of a completed DA Form 5140, Caution Tag.

must be used for all electrical works performed on de-energized lines and equipment operating above 600 volts. DA Form 5168-should be prepared by the worker who is authorized to receive and apply a safety clearance. The safety clearance order form should be typed or hand-written in "black" or “blue” ink pen or ballpoint pen and filled out as shown in figure 3–3. DA Form 5168-R will be reproduced on 8 1/2 - by 11-inch paper. A copy for reproduction purposes is located at the back of this manual. The preparation of the Safety Clearance Order form follows—

(a) Block 1, Order Number. The Order number will consist of two sets of numbers separated by a hyphen. The first set will consist of two digits representing the current year. The second set will consist of four digits beginning with the number "0001". For example: 99-0001.

(b) Block 2, Other Number. If there are other clearances and or cautions which are in effect on the system or equipment for which the clearance is being requested, the individual who issues the safety clearance will enter the order numbers of these clearances/cautions in block 2.

(c) Block 3, Station/Installation. The name of the station/substation or facility where the system or equipment is physically located will be entered in block 3 by the individual who requests the clearance.

(d) Block 4, Line or Equipment Involved. The description of the line or equipment on which the work is to be performed will be entered in block 4 by the individual who request the clearance.

(e) Block 5, Time Applied. The individual who applies the clearance order will enter the time when each task is completed. The 24-hour system will be used. Military (hhmm) or civilian time (hh:mm) may be used on all forms. For example: 1500 or 15:00.

(f) Block 6, Details of Clearance Procedure. The details of the tasks needed to complete the clearance will be described in block 6. The tasks must be numbered in the order that they will be implemented. In the example substation #3 is shut down and repairs made. Clearance is temporarily lifted midway to test for operation. After the test, unit is shut down again and times recorded in the right hand column.

(g) Block 7, Time Removed. The individual who performs a clearance removal will enter the time when each task is completed. The procedures to remove a clearance will be in reverse order to that used for applying a clearance. The task action used for removing an order will be the Opposite action to that used for installing an order. For instance, if the task action used to install a clearance order is “Open switch A", the task action used to remove a clearance order is "Close Switch A".

(h) Block 8a, Issued To. The name of the person who is authorized to receive and implement the safety clearance will be entered in block 8a by the issuing authority.

(i) Block 8b, Issued By. The name of the person who issues the safety clearance must be entered in block 8b. In cases where the individual issuing and receiving the clearance is the same person the person's name will be entered in both the “Issued to" and "Issued by" blocks.

(j) Block 8c, Timed Issued. The time when the safety clearance is issued will be entered in block 8c by the person who issues the clearance.

(k) Block 8d, Date Issued. The date, month, and year when the clearance is issued must be entered in this block. Numerical or alphanumerical forms may be used on all forms. For example: 24-12-1999 or 24 Dec 1999.

(l) Block 9a, Released By. The name of the person who releases the clearance must be entered in block 9a.

(m) Block 9b, Accepted By. The name of the person who accepts the released clearance must be entered in block 9b. In cases where the individual accepting release and releasing the clearance is the Same person the person’s name will be entered in both the “Released By" and "Accepted By" blocks.

(n) Block 9c, Time Released. The time when the clearance is released will be entered in block 9c by the person who accepts the released clearance.

(o) Block 9d, Date Released. The date, month, and year when the clearance is released will be entered in block 9d by the person who accepts the released clearance.

(2) *Safety clearance order logbook.* All information relative to issuing and releasing clearance orders must be recorded in a logbook. This logbook will also document information on accidents that occur during a given clearance.

(3) *Safety clearance order record file.* Separate files are required for active (still in effect) and inactive (released) safety clearance orders. Inactive files should be maintained within the organization's record keeping system according to AR 25-400-2.

(4) *Special cases.* Three special cases exist.

(a) Operation of the system or equipment during a clearance is not authorized while the clearance is in effect. However, when it is necessary for the system or equipment or parts thereof to be operated for purposes of operational or after-maintenance, testing, a temporary lift of the clearance could be applied. There are no restrictions on the total number of temporary lifts that can be issued relative to a given safety clearance order. However, only one temporary lift will be in effect for a given clearance at a time. In addition, if the system or equipment has multiple safety clearances applied, a temporary lift is required for all the clearances in effect. The issuing authority must coordinate all parties involved to ensure safety of all personnel.

(b) Temporary lifts of clearance. When more than one temporary lift of clearance is needed for the job each temporary lift should be annotated alphabetically. The first temporary lift of clearance should be given the letter "A". The next temporary lift of clearance should be given the next letter "B", and so on. The detailed description for each task performed during a temporary lift of clearance should be listed and numbered. The number assigned for each task performed during a lift of clearance will be based on the number given to a related task listed on the original order but is annotated with the alphabetical letter of the temporary lift of clearance as illustrated in figure 3–3. The time when a task is applied and removed during a lift of clearance should be entered by the individual who applied for the lift of clearance.

(c) At an attended substation, the operations of the system or equipment during a lift of clearance should be carried out by the operator on duty.

(5) *DA Form 7407-R, (Caution Order (Electrical Facilities)).* This form is used to direct electrical workers' attention to abnormal, hazardous, and unusual conditions of an electrical system or device. The caution order differs from the safety clearance order in that the system equipment may be operated while the caution is in effect. The Caution Order is normally used in conjunction with a clearance to address the conditions of the system or equipment which are not mentioned in the clearance order. However, the caution cannot be used in lieu of a clearance. DA Form 7407-R will be reproduced on 8 1/2-by 11-inch paper. A copy for reproduction purposes is located at the back of this manual. The preparation of the Caution Order form follows—

(a) *Block 1, Order Number.* The Order number will consist of a letter X followed by two sets of numbers. The first set of numbers will consist of two digits representing the current year. The second set of numbers will consist of four digits beginning with the number "0001". For example: X94-0001.

(b) Block 2, Other Number. If there are other clearances or cautions which are in effect on the system or equipment for which the caution order is being requested, the individual who issued the caution order will enter the order numbers of these clearances or cautions in block 2.

(c) Block 3, Station/Installation. The name of the station, substation, or facility where the system or equipment is physically located will be entered in block 3 by the individual who requests the caution.

(d) Block 4, Line or Equipment involved. The description of the line or equipment to which the caution will be applied, will be entered in block 4 by the individual who requests the caution.

(e) Block 5, Time Applied. The time when a task (listed in the Details of Caution Procedures) is applied and completed will be entered in this block by the individual who performed the task. The 24-hour system will be used.

(f) Block 6, Details of Caution Procedures. The details of caution procedures will depend upon the intent of the caution. For a caution order which involves only switching, tagging, or blocking, the detail of tasks that need to be performed to complete the caution should be described in block 6. For a caution order which stipulates the operation of an electrical device or equipment, the operating instructions must be entered. Where the instructions have an assigned number this number could be entered. The details of the procedures must be numbered in the sequential order that they will be implemented.

(g) Block 7, Time Removed. The procedures to remove a caution order will be performed in the reverse order to that used for applying the caution order. The task action used to remove an order will be the opposite to that used for installing an order. For instance, if the task action used to install a caution order is “Open switch A” the task action used to remove an order is “Close Switch A”. The time when

a task (to remove an order) is completed will be entered in block 7 by the individual who performed the task.

(h) Block 8a, Issued To. The name of the individual who is authorized to receive and apply a caution order will be entered in block 8a by the issuing authority.

(i) Block 8c, time Issued. The name of the individual who issues a caution order must be entered in block 8b. In cases where the individual issuing and receiving the caution order is the same person the person's name will be entered in both the "Issued To" and "Issued By" blocks.

(j) Block 8c, Time Issued. The time at which a caution order is issued will be entered in block 8c by the person who issues the order.

(k) Block 8d, Date Issued. The date, month, and year when a caution order is issued must be entered in this block. Both numerical and alphanumerical forms could be used.

(l) Block 9a, Released By. The name of the person who releases the caution order must be entered in block 9a.

(m) Block 9b, Accepted By. The name of the person who accepts the released caution order must be entered in this block.

(n) Block 9c, Time Released. The time at which a caution order is released will be entered in block 9c by the individual who accepts the released caution order.

(o) Block 9d, Date Released. The date, month, and year where the caution order is released will be entered in block 9d by the person who accepts the released caution order.

(6) *Caution order logbook.* All information relative to issuing and releasing caution orders must be recorded on a logbook. This logbook will also document all operations of the system or equipment while the caution is still in effect.

(7) *Caution order record file.* Separate files are required for active (still in effect) and inactive (released) caution orders. Inactive files should be maintained within the organization's record keeping system according to AR 25-400-2.

(8) *Special applications.* Caution orders remaining in effect for an extended period must be reviewed annually at a minimum to determine if the requirement still exists. Results of the review must be communicated to all elements of the operation. Caution orders issued for abnormal/unusual conditions of an electrical system or equipment which cannot be corrected will become a part of the equipment's permanent record and may remain indefinitely. Caution orders issued for abnormal/unusual condition of mobile equipment must be transferred from the losing issuing authority to the gaining issuing authority when the equipment is transferred between authorities. In this case a duplicate of the order is prepared and forwarded to the gaining, issuing authority and the caution tag is left attached to the applicable device.

(9) *DA Form 7408 (Danger Tag) (fig. 3–5).* Danger Tags must be used in conjunction with the DA Form 5168-R (Safety Clearance Order), and must be applied with each safety clearance issued. The tag must never be used for any purpose other than the protection of personnel working under a safety clearance order. A tag is applied to systems and equipment to ensure that a device's position will not be changed by unauthorized persons as long as the system or equipment has an active safety clearance in effect. The tag can only be removed by the individual who installs the tag or an authorized person designated by his/her supervisor.

(a) Main Hold Tag. The front side of the Danger Tag is designated as the "Main Hold Tag". The Main Hold Tag is used to attach to a primary disconnecting device of a circuit to ensure that the position of the device will not be changed by unauthorized persons as long as the tag is attached. A Main Hold Tag will be applied for each safety clearance issued and remain attached for as long as the safety clearance order is in effect.

(b) Preparation of Main Hold Tag. The Main Hold Tag will be prepared by the individual who issues the tag. It will contain data consistent with that listed on the associated Safety Clearance Order, such as substation name, clearance order number, line or equipment involved, issuing authority, applying authority, date and time applied. Where an Auxiliary Hold Tag is used in conjunction with a Main Hold Tag, the location (or placement) of the Auxiliary Hold Tag will be listed on the Main Hold Tag. The name of the worker who installs the Auxiliary Hold Tag will also be entered. The name of the station/substation or facility where the system or equipment is physically located will be entered in this block by the individual who requests the clearance. The clearance number must be entered in this block by the individual who issues the Danger Main

Hold Tag, as given on the Safety Clearance Order form. The tag number will be one (1) when the tag is used as the Main Hold Tag. The tag number will be entered by the individual who issues the tag. The description of the line or equipment on which the work is to be performed will be entered in the "Clearance On" block by the individual who issues the Danger Main Hold Tag. The name of the individual who receives the Danger Tag will be entered in the "Issued To" block by the issuing authority. The name of the individual who issues the Danger/Main Hold Tag must be entered in the "Issued By" block. In cases where the individual issuing and receiving the Danger/Main Hold Tag is the same person, the person's name will be entered in both the "Issued To" and "Issued By" blocks. The date, month, and year when the Main Hold Tag is installed must be entered in the "Date" block by the individual who installs the tag. Both numerical and alphanumerical forms could be used. For example: 24-12-1999 or 24 Dec 1999. The time when the Main Hold Tag is installed will be entered in the "Time" block by the individual who installs the card. The 24-hour system will be used. Both military form (hhmm) and civilian form (hh:mm) could be used. For example: 1500 or 15:00. The name of the individual who installs the Auxiliary Hold Tag will be entered in the "Placed By" (Auxiliary Tag Placement Section) block by the individual who received the tag. The location where the Auxiliary Hold Tag is to be placed, as specified in the Safety Clearance Order, will be entered in the "Location" (Auxiliary Tag Placement Section) block by the issuing authority. The name of the individual who removes the Auxiliary Hold Tag will be entered in the "Removed By" (Auxiliary Tag Placement Section) block by the individual who receives the tag.

(c) Auxiliary Hold Tag. The back side of the Danger Tag is designated as the "Auxiliary Hold Tag". The Auxiliary Hold Tag is used to attach to subsystem disconnecting devices to disable subsystem circuits which may affect the system or equipment that is being worked on.

(d) Preparation of Auxiliary Hold Tag. The Auxiliary Hold Tag will be prepared by the individual who issues the tag. It will contain data consistent with that listed on the Main Hold Tag such as clearance order number, line/equipment involved, issuing authority and so on. The clearance number must be entered by the individual who issues the tag. This number was given on the Safety Clearance Order form. The tag number entered must match with the assigned number listed on the "Tag Number" column of the Main Hold Tag, where the location of the Auxiliary Hold Tag matches with the location described on the Main Hold Tag. The same number will also be entered on the "Tag No" block on the other side of the tag. No other information is necessary on the other side of the tag when the tag is used as an Auxiliary Hold Tag. The name of the individual who installs the Auxiliary Hold Tag will be entered in the "Placed By" block by the individual who receives the tag. This name should also be entered on the Main Hold Tag. The times when the Auxiliary Hold Tag is installed will be entered by the individual who places the tag. The name of the individual who receives the Auxiliary Hold Tag will be entered in the "Issued To" block by the issuing authority. The location where the Main Hold Tag is installed should be filled in by the issuing authority. The description of the line or equipment held by the Auxiliary Hold Tag must be filled in by the issuing authority. The location where the ground rod is installed for this clearance should be entered by the issuing authority. This ground location must be filled in conjunction with the Main Hold Tag.

(e) Danger Tag Holder. The Danger Tag must be placed inside a tag holder to prevent damage caused by weather or destructive operation of the electrical equipment or devices. Tag holders must be of a nonconductive, see-through (that is clear plastic) material designed for installation with a switch stick.

(f) Special applications are as follows: Gang-operated switches must be locked open and an appropriate number of danger tags (one for each safety clearance) must be applied to the lock. Likewise, a turbine throttle valve must be locked in the closed position and tagged. For overhead lines, a visible line-break must be provided at all points of possible feed. An open oil circuit breaker is not acceptable. When an oil circuit breaker must be used, the line-side leads must be removed from the breaker bushings and the breaker must be mechanically blocked open, locked-out, and tagged. In addition, a voltage test will be used to determine that the lines are de-energized. Protective grounds will be installed on the lines as close as possible to the oil circuit breaker.

WARNING:

Perform the voltage test to verify that the circuit is de-energized before installing protective ground or serious injury may occur. For underground systems, a visible line-brake must be provided when feasible. When an oil circuit breaker or oil-disconnect switch must be used, the same requirements as specified for overhead lines must be met. Oil fuse cutouts must be blocked and locked in the open position. The fuse block must be removed and the clamp must be danger tagged.

(10) *DA Form 5140 (Caution Tag). (Fig. 3–6).* Caution Tags are normally used to attach to an electrical system or equipment to direct attention of electrical workers to the abnormal, hazardous, and unusual operating conditions of the system or equipment or device. The caution differs from the clearance in that the system or equipment may be operated while the caution is in effect. The caution cannot be used in lieu of a clearance.

(a) Preparation of Caution Tag. The front side of the tag should be prepared by the individual who issues the tag. The back side of the tag should be signed by the individual who operates the equipment. On side A the Caution Order number must be entered in this block by the individual who issues the tag. This number is given on the Caution Order form. The name of the station, substation, or facility at which the effected equipment or electrical device is physically located will be entered by the issuing authority. The description of the line or equipment to which the caution tag will be attached will be entered by the issuing authority. The abnormal conditions and unusual operating characteristics of the system or equipment must be entered in this block by the issuing authority. Special instructions needed to operate an electrical system or run equipment or a device should be entered in this block by the individual who issues the tag. The time in minutes needed to wait before closing or reclosing a circuit or operate electrical equipment should be entered by the issuing authority. The name of the individual who requests the caution order will be entered by the issuing authority. The name of the individual who approves the caution order will be entered by the issuing authority. The name of the individual who installs the tag will be entered in the "Placed By" block by the individual who receives the tag. The name of the individual who releases the tag will be entered by the individual who receives the released tag. The name of the individual who authorizes the release of the tag will be entered in the "Ordered Off By" block. Normally, the issuing authority approves the release of the tag. The name of the individual who removes the tag will be entered by the issuing authority. On side B, the name of the individual who operates the system or equipment while the caution tag is still in effect must enter his/her name. The time when the system or equipment is operated while the caution is still in effect will be entered by the operator. The date, month, and year when the system or equipment is operated while the caution is still in effect will be entered by the operator.

(b) Caution Tag Holder. The Caution Tag must be placed inside a tag holder to prevent damage caused by weather or destructive operation of the electrical equipment or device. Tag holders must be of a nonconductive, see through (that is, clear plastic) material designed for installation with a switch stick.

(c) Special applications. Caution Tags which remain in effect for an extended period, must be inspected monthly as a minimum to determine that the tags are physically attached, and protected from inclement weather.

d. Safety Clearance/Caution Order processing. The Safety Clearance/Caution Order processing is as follows:

(1) The individual authorized to receive a Safety Clearance/Caution Order must prepare the Safety Clearance Order, DA Form 5168-R, and or the Caution Order, DA Form 7407, and submit the requested order(s) to the individual who has authority to issue the order(s). The requester must provide a detailed description of all tasks which are required for the system or equipment isolation and personnel protection.

(2) The individual authorized to issue a Safety Clearance/Caution Order will—

(a) Receive the request for Safety Clearance/Caution Order.

(b) Review the system or equipment status to determine if other workers will be affected by the requested/Clearance/Caution Order, and determine the appropriate action to take in such a case.

(c) Make all necessary arrangements for scheduled outages, such as notifying the customers and utility company, if necessary.

(d) Issue the Safety Clearance/Caution Orders and Danger/Caution Tags necessary for the job.

(e) Record and follow up the all clearances in effect.

(3) The individual who received the approved Safety Clearance/Caution Order, has authorization to request a temporary lift of clearance. He/she must prepare and submit to the issuing authority a supplemental Safety Clearance Order, DA Form 5168-R.

(4) The individual who receives the request for temporary lift of clearance will review the system or equipment status to determine if other workers will be affected by the lift of clearance and determine the appropriate action to take in such a case.

(5) The individual who received the approved temporary lift must perform all tasks as outlined in the supplemental Safety Clearance Order form.

(6) The issuing authority will have authorization to approve the release of temporary lift and Safety Clearance or Caution Order. No release of safety clearance/caution can be performed before the release was approved.

(7) The individual authorized to release a Safety Clearance/Caution must complete all tasks listed on the approved order, but in reverse order and opposite sequence from that in which the tasks are applied. For instance, if a task reads "Open Switch A" when a clearance is applied, the opposite operation is "Close Switch A".

3-9. General rules for de-energized line work

The following rules should be applied for all de-energized line work.

a. Low voltage de-energized line work (600 Volts and below). All de-energized lines/equipment/apparatus to be worked on should be securely grounded to a common grounding electrode. An equipotential voltage between the line/equipment/apparatus to be worked on and the platform on which the worker stands must be checked before starting work. An approved voltmeter, scope meter, or voltage detector must be used for this test. All automatic devices such as automatic transfer switches should be physically turned off or disconnected if it is possible. All stored energy sources such as power factor capacitors should be properly drained to ground. The grounding conductor used to drain the stored energy should be retained until the work is completed. In cases where the lines/equipment/apparatus should not be grounded the foreman must explain to his/her crew the reasons for not grounding. All other energized lines, equipment, or apparatus which are not connected to the system to be worked on, but are within the reaches of electrical worker, should be covered with insulated protective equipment. Always treat bare wires such as ground wires of uninterruptible power systems or communication systems, as energized lines.

b. Medium and high voltage de-energized line work (above 600 volts). The following rules must be applied before starting any line work:

(1) Clearly understand the instructions and work requirements.

(2) Prepare all necessary tools and equipment.

(3) Prepare safety procedures.

(4) Apply personal protective equipment.

(5) Perform a safety clearance for lines/equipment/apparatus to be worked on.
Note: When installing a temporary ground for a line, equipment, or apparatus the connection to ground must be made first. Before making a connection to an electric line/equipment/apparatus, test for static discharge with a switch stick as an added precaution. When removing a temporary ground, disconnect the ground connection last.

(6) Cover all other energized lines/equipment within reach with insulated equipment such as rubber line hose, insulator hoods, or rubber blankets.

(7) Discharge all surge arresters and stored energy devices, if existing.

(8) Guard the working area with suitable barriers and warning signs from access by unauthorized persons.

(9) Before starting work, check the equipotential voltage between the line/equipment/apparatus to be worked on and the platform where the worker will stand.

(10) Before cutting a cable, be sure that the cable has been correctly identified by your foreman by checking the duct and cable location against that shown on working print or by cable identification tags. The working print must also be checked against the facility engineer's map records. Cables can also be identified with the aid of an exploring coil by listening for a pulsating beat imposed on the cables by sending an interrupter signal.

(11) After the cable has been identified and grounded, remove a three inch strip of covering around cable and test with a voltage detector at two or more points near the center of the exposed insulation. Repeat the test with another voltage detector if it is available. Alternatively, a spiker can be used, as described in paragraph 7–5.

(12) When cutting cable, place a hacksaw on the exposed cable insulation adjacent to and touching the grounded metallic shield or sheath or the temporary ground on the shield or sheath before cutting.

(13) Do not approach or touch reactors and connected equipment unless it has been proven that they are de-energized and grounded.

(14) When the worker changes position he/she must check all energized lines within his/her reach again and re-cover them with insulated equipment when it is necessary before starting the new work.

3–10. Permanent and temporary ground

A permanent ground is installed for safe operation of electrical power systems and devices. A temporary ground is used for electrical worker's safety when engaged in electrical services.

a. Purpose of grounding. The purpose of a grounding is to limit the potential differences resulting from fault conditions to values that are safe when touched by a human body. This assures that a person in the vicinity of working area is not exposed to the danger of critical electric shocks.

b. Definition of grounding terms.

(1) *Ground:* A conducting connection, whether intentional or accidental, between an electrical circuit or equipment and the earth or to some conducting body that serves in place of the earth.

(2) *Grounded:* Connected to earth or to some conducting body that serves in place of the earth.

(3) *Effectively grounded:* Intentionally connected to earth through a ground connection or connections of sufficiently low impedance and having sufficient current-carrying capacity to prevent the buildup of voltages that may result in undue hazards to connected equipment or to persons.

(4) *Grounded conductor:* A system or circuit conductor that is intentionally grounded.

(5) *Grounding conductor:* A conductor used to connect equipment or the grounded circuit of a wiring system to a grounding electrode or electrodes.

(6) *Equipment grounding conductor:* The conductor used to connect the noncurrent-carrying metal parts of equipment, raceways, and other enclosures to the system grounded conductor, the grounding electrode conductor, or both at the service equipment or at the source of a separately derived system.

(7) *Grounding electrode conductor:* The conductor used to connect the grounding electrode to the equipment grounding conductor, to the grounded conductor, or to both of the circuits at the service equipment or at the source of a separately derived system.

(8) *Ground-fault circuit-interrupter:* A device intended for the protection of personnel that functions to de-energize a circuit or portion thereof within an established period of time when a current to ground exceeds some predetermined value that is less than that required to operate the overcurrent protective device of the supply circuit.

(9) *Ground-fault protection of equipment:* A system intended to provide protection of equipment from damaging line-to-ground fault currents by operating to cause a disconnecting means to open all ungrounded conductors of the faulted circuit. This protection is provided at current levels less than those required to protect conductors from damage through the operation of a supply circuit overcurrent device.

(10) *Reference ground.* A conducting body such as the earth and the metal frame of a building to which an electric potential is referenced.

c. Types of grounding. Five types of grounding will be described in the section: power system grounding, equipment grounding, electrostatic grounding, lightning protection grounding, and temporary grounding.

(1) *Power system grounding.* Power system grounding has three main functions:

(a) Stabilize the system voltage to ground.

(b) Limit the overvoltages produced by lightning stokes, line surges, or unintentional contact with higher voltage lines.

(c) Facilitate the operation of overcurrent protective devices such as fuses, circuit breakers, reclosers, and relays under ground-fault conditions.

(2) *Equipment grounding.* The main function of equipment grounding is to provide a low impedance path for fault currents to flow back to the source to activate the operation of overcurrent protective devices under ground-fault conditions.

(3) *Electrostatic grounding.* The generation of static electricity is not a hazard in itself. However, the hazard arises when an accumulated static electric charge is subsequently discharged as a spark. Occupancies where flammable or explosive liquids, gases, dusts, or fibers are present need an electrostatic grounding to reduce sparking.

(4) *Lightning protection grounding.* The estimated energy dissipated by a direct lightning stroke is approximately 300,000,000 Joules or equivalent

to l0,000,000,000 kWatts or 66 kG of TNT. The National Electrical Code (NEC) requires a separate grounding system be used for lightning protection. Power system grounding cannot be used as lightning protection grounding.

(5) *Temporary grounding.* Temporary grounding is used for personal safety. A de-energized line located adjacent to an energized line is always subject to both capacitive and magnetic coupling from the live line which can induce voltage in the de-energized lines. In addition, accidental energizing of the lines, accumulation of static charges on the line, improper drain of power capacitors, or surge arresters are other hazards for electrical workers. Temporary grounding shall be applied to all lines, equipment, or apparatus to be worked on and remain until the work is completed.

(a) Installation. Before installing a temporary ground, the line/equipment/device must be tested for differential voltage. Proper clearance distance and hot-line tools must be applied even when the line/equipment/device is de-energized. Temporary grounding shall be installed at both ends of the line/equipment/apparatus to be worked on when it is necessary. All conducting objects such as static lines, transformer tanks, and platforms where the electrical workers stand shall be connected together to ground to prevent dangerous touch and step voltage.

(b) Grounding conductors. Temporary grounding conductors shall be of copper, rubber insulated, and flexible type. Aluminum grounding conductor is not permitted. Since the resistance of a conductor is proportional to its length, temporary grounding conductors shall be kept as short as possible. In general, grounding conductor length should be limited to 30 feet. Sharp bending of grounding conductors should be avoided. The size of grounding conductors will depend on the maximum fault currents available at the service location. Table 3-6 provides recommended sizes for grounding conductors. Where two or more grounding conductors are used the maximum fault currents listed in this table can be derated by a factor of 0.9. Temporary grounding conductors should have the same length if they are connected at both ends of a line, piece of equipment, or apparatus.

(c) Grounding electrodes. The temporary grounding electrode should be driven at least 6 feet into ground. Where a permanent grounding electrode exists, it can be used instead of a temporary grounding electrode. However, the permanent grounding electrode should be checked for good condition before use.

Table 3–6. Recommended Grounding Cable Sizes

Cable Sizes in Copper (AWG)	Fault time (cycles)	Maximum Fault Currents in Amperes
2/0	15 30	27,000 or less 20,000
3/0	15 30	36,000 25,000
4/0	15 30	43,000 30,000

d. What needs to be grounded. All metal electrical component enclosures, maintenance vehicles, equipment, or devices located within or near working areas shall be properly grounded to a common grounding point.

(1) *Electrical component enclosures.* All metal enclosures for electrical components such as transformers, circuit breakers, switches, switchgear, and reclosers located within or near working areas must be properly grounded to a common grounding electrode (either temporary or permanent), through approved grounding conductors.

(2) *De-energized electrical components.* All de-energized electrical components such as overhead lines, power transformers, and capacitors shall be properly grounded to a common grounding electrode (either temporary or permanent), through approved grounding conductors. The grounding conductors shall remain until the electrical work is completed.

(3) *Aerial electrical grounding components.* All aerial electrical grounding components such as lightning arrester grounding wires, metal pole, pole-mounted transformers grounding wires, and static wires located near or within working areas must be properly grounded to a common grounding electrode (either temporary or permanent) through approved grounding conductors.

(4) *Maintenance vehicles.* When maintenance vehicles such as a utility trucks or boom trucks are parked within minimum approach distances listed in table 3-8. The vehicles' chassis must also be properly grounded to the common grounding electrode (either temporary or permanent) for the service area through an approved grounding conductor.

(5) *Platform or boom where the worker stands should be bonded to the lines/equipment/devices to be worked on.* An equipotential between the platform or boom where the worker stands and the line/equipment/device to be worked on must be checked by an approved instrument before starting work. All

electrical conducting material within reach of worker must be covered with approved protective equipment such as rubber blankets. Proper personal protective equipment such as rubber gloves and hard hats must be worn and proper tools should be used.

(6) Other equipment such as diggers and cranes should be bonded, if practicable, to the common grounding electrode (either permanent or temporary).

3–11. General rules on electrical grounding

The following rules should be applied for the grounding of de-energized circuits:

a. All lines/equipment/apparatus regardless of voltage, should be considered as energized unless short-circuited and grounded with approved grounding devices.

b. The temporary grounding conductor should be checked for proper size, good condition, and continuity before each use. When installing a temporary grounding conductor the connection to ground should be made before the connection to a de-energized line, device, or apparatus. A proper hot stick should be used when connecting a temporary grounding conductor to a deenergized line, piece of equipment or apparatus. When removing a temporary grounding conductor, the connection to a de-energized line/equipment/apparatus should be removed first. The temporary grounding conductor should remain until the job is completed and all energized lines or pieces of equipment have been cleared.

c. Where ground switches are installed they must be approved for use as a ground switch. Safety clearance should be applied when the normal operating position of a ground switch is changed.

d. When it is necessary to ground lines above energized circuits the following preliminary precautions must be taken according to the voltages of the energized circuits below the lines to be grounded:

(1) Circuits carrying voltages up to 15,000 volts must be covered with proper protective equipment.

(2) Circuits carrying voltages larger than 15,000 volts must be de-energized.

e. When work is to be done on single-feed lines the temporary ground should be installed between the work and the source of power. In no case should the work be done farther than one mile from the temporary ground.

f. When work is to be done on double-feed lines a temporary ground should be installed on each side of the work. The distance between these two temporary grounds should not exceed 2 miles.

g. When work is to be done on energized lines equipped with pole gaps in the ground wire, bridge such gaps with ground clamps or suitable gap bridging devices before climbing to positions above them.

h. When electrical testing requires that circuits or equipment not be grounded apply the protective grounds first and then temporarily remove them only for the immediate period of the test. All disconnecting devices isolating the circuit or equipment must be locked or blocked open with correct lockout and tagout procedures.

i. When installing grounding equipment on wood pole lines, first sink a ground rod at least six feet into earth. Attach the ground device securely to this rod and then to the conductor keeping as far below the line conductor as possible. Be sure that your body does not come in contact with ground wire or the line conductor. Start at the lowest line conductor and ground each line conductor working upwards and being sure to use the same ground rod for all line conductors.

j. When installing grounding equipment at substations, first securely attach the ground device to the station grounding system and then to each line conductor keeping as far away as possible and below the line conductors if practical. Be sure that your body does not come in contact with the ground wire or line conductor.

k. To remove the protective ground, first remove the ground device from each line conductor keeping as far away as possible and being sure your body does not come in contact with the ground wire or line conductor. Then remove the grounding device from the station grounding system.

3–12. Energized-line work

Energized line work is defined as work performed on a line, equipment, or apparatus which is connected to an energized electrical power source or a stored energy source that is not properly discharged. Synonyms of energized are live, hot, or alive.

a. Permitted work. No energized line work can be performed unless it is permitted by the supervisor in order to maintain continuous power for a critical load within an installation. The permission should be based on the qualification of the workers and the availability of the tools, equipment, and personal

protective equipment.

b. Requirements for energized line work. The following requirements must be observed when performing energized line work:

(1) Workers must be–

(a) Specially trained and qualified for energized line work.

(b) In good health.

(c) Not under influence of alcohol and drugs.

(d) Free of emotional, psychological~ and financial problems.

(e) Familiar with the safety procedures and application.

(f) Familiar with the use of tools and equipment. When a bucket or elevated platform is used, the worker should be familiar with the technique and operation of the equipment or device.

(g) Familiar with the technique and application of the bucket

(h) Familiar with system/equipment/apparatus to be worked on and elevated platform when it is used.

(2) Tools and equipment must–

(a) Be specially made for energized line work.

(b) Meet applicable acceptance test standards.

(c) Have proper voltage class.

(d) Be cared for and maintained to meet in-service standards.

(e) Be visually checked for damage before each use. Damaged tools or equipment must be removed from services immediately.

(f) Be tested in accordance with the American Society for Testing and Material (ASTM) F18 by approved laboratories or manufacturers every six months.

(3) Low, medium, and high voltage services–

(a) Low voltage (600 volts and below). Except for circuit switching or fuse replacement, services on energized lines/equipment/apparatus operating at 600 volts and below between conductors should not be performed unless the following conditions are satisfied. Determining whether it is necessary to main continuous power to the critical loads. Preparing a safety plan for the job. This should also include an emergency escape plan. Having proper tools, equipment, and personal protective equipment available. Preparing a working method for the job. Checking the weather forecast. Never performing energized line work when it rains, snows, sleets, or storms. Never performing work on a wet line or piece of equipment. Checking the working environmental conditions. Never performing energized line work when the surrounding atmosphere is full of dust or hazardous gases. Isolating the working area from entrance of unauthorized persons with suitable barriers. Covering all other energized lines, ground wires and metal objects within reach with approved insulating protective equipment such as rubber line hose, insulator hoods, and rubber blankets. Covering all joints and loose ends of conductors with approved electrical tapes or insulated wire connectors.

(b) Medium voltage (600 to 17,000 volts). Except for circuitswitching or fuse replacement, services on energized lines or equipment operating at 600 to 17,000 volts between conductors should not be performed unless the conditions required for medium voltage systems are satisfied, plus the following. All energized line works must be performed under direct supervision of at least a qualified foreman. No electrical worker is permitted to work on any energized line/equipment/apparatus at a distance shorter than that required by OSHA 29 CFR 1910 .269 and 29 CFR 1926 (See paragraph 3–12b (4) and table 3–7). Non-electrical workers, such as laborers, are not permitted to approach any energized line, equipment, or apparatus which is located within the limits required by OSHA 29 CFR 1910.269 and 29 CFR 1926 without proper personal protective equipment (See paragraph 3–12b (5) and table 3–8). Proper personal protective equipment must be worn by all workers (including non-electrical workers) when approaching an energized line, equipment, or apparatus. At least two qualified electrical workers (including the foreman) must be present at the site for each energized line being worked. No energized line work can be performed when the device to be worked on is not located in a secure position or when the worker is standing on a moving or unstable platform. Do not raise, move, or lower any energized line more than 18 inches.

(c) High voltage, (17,000 volts and above). Except for the circuit switching or fuse replacement,

Table 3–7. Minimum Safe Working Distances

Voltage Range (Phase-to-Phase)	Minimum Safe Working distance	
	Phase to Ground	Phase to Phase
50V to 1kV	Space	Space
1.1 to 15kV	2ft 1in (0.64m)	2ft 2in (0.66m)
15.1 to 36kV	2ft 4in (0.72m)	2ft 7in (0.77m)
36.1 to 46kV	2ft 7in (0.77m)	2ft 10in (0.85m)
46.1 to 72.5 kV	3ft 0in (0.90m)	3ft 6in (1.05m)

Table 3–8. Minimum Safe Approach Distances

Voltage to ground	Distance
-50kV or below	10ft
-for every 10 kV over 50kV	Add 4 inches to the initial 10ft

work on energized lines or equipment operating at 17,000 volts and above between conductors is not recommended for U.S. Army facility electrical workers. Maintenance on high voltage electrical distribution systems (17,000 Volts and above) should be performed by qualified contracting personnel.

(4) *Minimum safe working distances.* When working on energized lines the minimum safe working distance must always be observed. The safe working distance is defined as the distance between the worker's body and the energized part of the system or equipment to be worked on, dependent on the voltages where the work is performed. Table 3–7 provides the minimum safe working distances required by Occupational Safety and Health Administration (OSHA) 2g CFR 1910.269 and 29 CFR 1926.

(5) *Minimum safe approach distances.* The minimum safe approach distance is defined as the shortest possible distance that an unqualified worker such as laborer or groundman can approach without danger. Table 3–8 lists the minimum safe approach distances required by OSHA 29 CFR 1910.269 and 29 CFR 1926.

c. Protective equipment voltage classes. Protective equipment classification is based on the use voltages. The equipment must pass the required proof voltage tests and be cared for to meet in-service standards. Table 3–9 provides the voltage class, color label code, and maximum use voltages for personal protective equipment. Under-rated protective equipment should not be used. In addition, whenever a worker feels a tingle when handling a tool, the service must be stopped and the tools must be replaced. The tingle signals that the protective equipment's insulating capability has been reduced. The equipment must be sent to approved laboratories or manufacturers for testing before being reused.

d. Work methods. Work method is defined as the method that can be applied for energized line work dependent on the nominal voltages of the system. Table 3–10 provides general energized line work methods that most utilities companies use.

e. Categories of energized line work. The categories of energized line work are based on the location where the worker stands to perform the work.

(1) *Workers at ground potential.* Workers are located on the structure or platform supporting the line/equipment/apparatus which is directly connected to ground via a proper grounding conductor. Proper insulating tools and personal protective equipment should be used.

(2) *Workers at intermediate potential.* Workers are isolated from the ground and grounded objects by an insulating means such as an aerial lift or an insulating ladder. Proper insulating tools and personal protective equipment should be used.

(3) *Workers at line potential.* Workers are bonded to the energized line/equipment/apparatus on which work is to be performed and are insulated from the ground, grounded objects, and other energized devices that are at a different potential. This is commonly known as the barehand technique and

Table 3–9. Protective Equipment voltage Classes.

Maximum Use Voltages (Volts)	Class	Color Label	Proof Test Voltages (Volts)	Min. distance Between collector Gauntlet and Glove Cuff (Inch/ mm)
1,000	0	Red	5,000	1/25
7,500	1	White	10,000	1/25
17,000	2	Yellow	20,000	2/50
26,500	3	Green	30,000	3/75
36,000	4	Orange	40,000	4/100

Table 3–10. Energized Line Work Methods

Nominal Voltage Level	Work Method
Up to 750 volts	Gloving by conventional work position or by structure mounting (ground potential)
750 to 7,500 volts	Gloving from structure mounting or in a bucket (ground potential)
7,500 to 17,000 volts	Gloving from electrically insulated bucket or platform (intermediate protection) or use of live-line tools from structure mounting or a bucket (intermediate potential)
17,000 to 36,000 volts	Use of live line tool from an electrically insulated bucket (intermediate potential)

is not recommended for U.S. Army facility electrical workers.

f. Safety preparation. Safety preparation is of utmost importance in electrical work. The worker must be instructed in detail on safety measures and work procedures. Personal protective equipment such as rubber gloves, rubber blankets, and hot sticks should be visually checked for damage and good condition. When an insulated bucket is used the worker should be thoroughly trained and familiar with the operation of the bucket as well as cautions to be observed. Detail on insulated bucket operation is described in paragraph 4–11.

g. Safety check. Before starting work on an energized line or equipment the following safety checks must be performed.

(1) Check the voltage rating of the circuits to be worked on.

(2) Check the clearance to ground of lines and other energized equipment.

(3) Check the voltage limitations of the bucket equipment.

(4) Check that the conductive shoes, clips, and other devices to be used to connect the bucket liner to the worker are in proper operating condition.

(5) Check that the circuit automatic reclosing devices have been made inoperative while work is being performed.

(6) Check the condition of conductors, tie wires, and insulators to see if there are any signs of burns, cracks, damage, or defects.

(7) Check the voltage classes of personal protective equipment. Wear personal protective equipment when required. Personal protective equipment having lower voltage classes are not permitted at the site.

(8) All energized conductors, neutral conductors, ground wires, messengers, and guy wires in the proximity of the work site should be covered with approved protective equipment. The covering should be applied to the nearest and lowest conductor first and removed in reverse order.

(9) Special care should be exercised when working in the proximity of fuses, surge arresters, and like equipment. Procedures may require that they be bypassed for the duration of the work.

(10) Protective equipment should be removed at the end of the working day.